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(71) Applicant *(for all designated States except US)*: ABB AZIPOD OY [FI/FI]; Laivanrakentajantie 2, FIN-00980 Helsinki (FI).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: VARIS, Jukka [FI/FI]; Viherlaaksonranta 10 B 27, FIN-02710 Espoo (FI).

(74) Agent: BORENIUS & CO OY AB; Kansakoulukuja 3, FIN-00100 Helsinki (FI).

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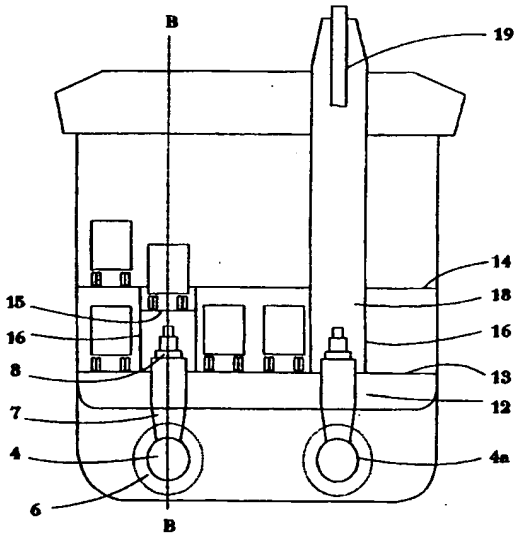
(54) Title: SPACE ARRANGEMENT IN A SHIP



(57) Abstract: The present invention relates to an arrangement in a ship having a first deck (13), which extends from the lower edge of a loading gate. A structure (15, 18) extending upwards from the main deck is positioned so that it constitutes a space for such parts (8) of a rotatable propulsion unit (4) which are to be located within the ship's body. The present invention also relates to a method and installation arrangement for using a space in a ship. Such portions (8) of the ship's propulsive steering means (4) which must be easily accessed for maintenance or the like purposes and/or whic are to be installed inside the ship are arranged in said structure (15, 18) which also serves other purposes.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Space arrangement in a ship

The present invention relates to an arrangement in a ship, said ship having a first cargo deck extending essentially at the level of the lower edge of a loading gate and at least one technical or functional structural part extending upwards from said level. The present invention further relates to a method for utilizing space in a ship, said ship having a gate in at least one end and a first cargo deck extending essentially at the level of the lower edge of said gate, from which deck such a structural part extends upwards. Favorably the ship has at least one further deck for cargo, to which leads an inclined loading ramp or the like. The present invention further relates to an installation arrangement for a propulsion unit rotatable in relation to the ship around a vertical axis, in which arrangement one portion of the propulsion unit is located outside the ship's hull and another portion, respectively, inside the ship's hull.

The propulsion of various ships or similar vessels (such as passenger ships and ferries, cargo ships, barges, oil tankers, icebreakers, off-shore vessels, military vessels, etc.) most usually is accomplished by a pushing or pulling force provided by a rotatable propeller or a plurality of propellers. For steering the ships, however, traditionally separate rudder equipment has been used.

Propeller drive or rotating arrangements traditionally are implemented such, that the drive apparatus for a propeller shaft, i.e. a diesel engine, a gas engine, or an electric motor, is positioned inside the ship's hull, wherefrom the propeller shaft extends to the outside of the ship's hull through a bushing, sealed to be watertight. The propeller as such is located at the other end, i.e. the end extending outside the ship, of the propeller shaft, which is connected either directly to the engine or to a possible gearing. This solution for accomplishing the necessary force for the pro-

pulsion of the ship is employed in the majority of all vessels used in water traffic.

Lately ships have also been equipped with such propeller units, where the direction of the pushing or pulling force provided by the propeller can be changed. In these units, the device for delivering the propulsion power to the propeller shaft (usually an electric motor), as well as any gearing, may be positioned outside the ship's hull within a special chamber which is supported to be rotatable in relation to the hull. According to another alternative, the propulsion power from an engine located inside the ship's hull is conveyed by mitre gears and drive shafts into a rotatably supported chamber located outside the ship (e.g. so called rudder propellers).

A propulsion unit with an electric motor inside a chamber is described in more detail in, for example, the applicant's Finnish patent No. 76977. Such units are commonly referred to as azimuthing propulsion units, and the applicant, for example, is offering such azimuthing units using the trade name AZIPOD.

Such a propulsion unit having a propeller and being located outside the ship is rotatable in relation to the ship's hull, and thus it can also be used, instead of a separate rudder device, for steering the ship. More particularly, the chamber containing a motor and/or a gear mechanism and any necessary drive shafts is rotatably supported in relation to the ship's hull by a special vertical tubular shaft or the like, which tubular extends through the bottom of the ship.

It has turned out, that by using an azimuthing propulsion unit in particular, in addition to the advantages attained by excluding the long propeller shaft and the separate rudder device, essential improvement also in the maneuverability of the ship is achieved. Also the energy efficiency for the ship has been found to improve. In recent years the use of

azimuthing propulsion units in various vessels for water traffic has become more common and the popularity of these units is believed still to increase.

The azimuthing propulsion unit described above also is particularly favorable in vessels having one or more car or cargo decks. Such vessels take advantage of the flexibility of a diesel-electric machinery, the advantages of the machinery arrangement in general, the redundancy advantages offered by the system, and the good maneuverability achievable by using an azimuthing propulsion device. Such vessels include e.g. passenger ferries and the like, where the deck, however, essentially is located at the same level as the ship's aft and/or bow gate, such that a loaded vehicle can be driven directly on to the deck from the quay. Larger vessels of this kind have several decks, usually such, that there is at least one further deck above a main deck, which further deck can be reached by driving up an inclined ramp.

The propeller devices and the rudder devices, which usually are located in the stern of the ship, are positioned underneath the main deck. However, the space available there, particularly in the vertical direction, is limited because the level of the main deck is determined largely on the basis of vehicle driving convenience on the one hand, and the stability of the vessel on the other. Thus, into such a space it difficult to fit any devices having a structural height higher than a very low one.

An aim in the production of azimuthing propulsion units is to make standard size units and to use standard parts as extensively as possible, whereby the service of the devices is easy and fast due to the exchangeability of the parts. Having a structure height above that of a low steering gear is not actually disadvantageous in other ships, but locating such a propulsion unit under the main deck in the kinds of vessels described above, which have an essentially flat main deck at a

low elevation, is often problematic and leads to impractical special arrangements in other respects.

The structural parts of an azimuthing propulsion unit located inside the ship include, among other things, devices for rotating the unit, cooling means for its motor, power supplying devices and the like means, good accessibility to which is desirable. It is possible, as such, to modify these devices into low height models, but that causes deviations from the standard arrangements. Since the thrust force from the propulsion unit is concentrated mainly to the location where the lead-through is implemented, this spot also generally is separately reinforced, in comparison to a structure, where just a conventional steering gear would be installed at the same location. Such special reinforcement also requires some vertical space. Thus there are many different grounds for arranging a ship in such a way that more vertical space would be available at the ship's stern.

According to the present invention this problem is solved in the manner disclosed in the appended claims. Thus, the arrangement according to the present invention is characterized in, that such a structural element of the ship, which element extends at least partially vertically, such as a loading ramp, companionway or similar structure extending upwards from the deck, is positioned so that at least a part of the space defined by said structural element at the same time forms a space for those parts of a propulsion unit being rotatable around a vertical axis relative to the ship, which parts are located within the ship's hull. Generally speaking, the invention can be defined as arranging those parts of the propulsion unit, which are to be installed inside the ship's hull, into a space extending upwards from the main deck, which space is defined in accordance with some other structure pertaining to the ship, which structure extends above the main deck and which is intended for mainly technical or operational functions. Thus, such parts of a steering gear providing

thrust to the ship, which have to be easily accessible for servicing or for some other reason, will be located, for example, in the space beneath a loading ramp.

The invention is described in more detail below by way of an example with reference to drawings disclosing some of its embodiments, wherein:

Fig. 1 shows a partial longitudinal sectional view of the stern of the ship along line B-B of Fig. 2, and

Fig. 2 shows a transversal sectional view of a ship including two propulsion units arranged side by side and in accordance with the description above.

According to Fig. 1, propeller devices providing thrust to a ship are usually positioned in the stern 1 of the ship. Conventionally such devices comprise a shaft 2 which is connected to the ship's engine and has a propeller 3 at the end. Lately, in addition to these common means, or instead of them, e.g. aforementioned azimuthing type propulsion arrangements, indicated generally by reference 4 in Fig. 1, have come into use. The arrangement disclosed in Fig. 1, which employs both a conventional propeller arrangement 3 and a rotatable propulsion device 4, is a particularly favorable arrangement in many respects, but such solutions are also in use, where the sole provider of steering power and thrust for the ship is one or more propulsion devices 4 arranged rotatable around a vertical axis.

As discussed above, the azimuthing propulsion device 4 shown in Fig. 1 comprises a motor housing 5 arranged rotatably around a vertical axis A-A, said housing containing an electric motor (not shown) having a propeller 6 attached to a shaft thereof. In practice, said motor housing 5 is arranged at the lower end of a rotatable tubular body 7, which at the upper end can be turned by a turning device generally referred

to as 8. Said turning device usually comprises a rim gear wheel 9 driven by a turning motor 10. Further, the turning device is considered to include a power supply arrangement for the motor, said arrangement including slip rings and control devices, generally referred to as 11. The complexity and structural height of the upper end of the assembly is increased by the fact that the motor itself usually is implemented as an air-cooled arrangement, and thus air ducts for both intake and exhaust (not shown) additionally pass through the upper end of the device.

Since the propulsion unit in practice directs a considerable thrusting force to the ship's stern 1, the stern is usually reinforced by special reinforcing structures, which in Fig. 1 are only generally referred to as 12.

Fore the reasons mentioned above, the propulsion unit structures located inside the ship's hull are often, in practice, high enough to render difficult the fitting of these structures completely underneath the main deck marked 13 even in a case, where the deck as such would be positioned as high up as functionally possible, as indicated by the dashed line marked 13a.

According to the present invention, however, space for the aforementioned propulsion unit superstructures 8 have been arranged under such a structural part of the ship, which part is intended for some other mainly technical or operational functions. Particularly suitable for this purpose are above all such structural parts which, e.g. due primarily to their inherent function, vertically penetrate the ship at least to some extent. According to Fig. 1, preferably used as such a structural part providing such space is a slanted loading ramp 15 rising essentially from the level of the main deck 13 and leading to a deck 14 located above the main deck 13, which ramp indeed, according to the present invention, has been positioned in such a manner that underneath the ramp there is

the necessary space for the propulsion unit's superstructures 8, 9, 10, and 11. In practice, this is suitably implemented by specifically aligning such a ramp 15 with the position of the propulsion unit 4. At the same time there is also preferably the possibility of forming a structure which stiffens all of the stern of the ship, said structure comprising the sloping part 15 of the ramp as well as preferably at least one vertical wall 16 extending under and/or at the side of the ramp. A particularly preferable arrangement is such that the ramp 15 and its vertical walls 16 constitute an integrated structure with the mounting fixtures for the propulsion unit 4. Fig. 1 shows that ample space for the upper end of the propulsion unit 4 is achieved by an arrangement according to the present invention, which significantly facilitates installation as well as servicing. At the same time any special arrangements, which up to the present time have been necessary, can be omitted.

In practice the loading ramp 15 is favorably arranged as a fixed structure leading up to the upper deck 14, which structure is positioned as far aft in the ship as possible, preferably such, that the aftermost part of the structure is located in close vicinity of the ship's aft gate 17. In some embodiments aforementioned propulsion units 4 can also be located at the bow of the ship, where a similar ramp arrangement can be implemented. In another solution the ramp 15 as such can be raised in a conventional way, in which case the ramp in a lowered state covers the upper portion of the propulsion device which then may include only a light cover. The space surrounding said upper portion can be used for other temporary needs. From the viewpoint of the present invention, however, it is essential, that a division of the main deck into traffic lanes has been made in a way which permits structures of the upper portion of the propulsion device to extend above the level of the main deck. In some cases this also entails that said superstructures are located within a wall structure dividing the main deck.

Fig. 2 discloses how an arrangement according to the present invention also can be implemented when several azimuthing propulsion units are arranged side by side. In that case several parallel ramps 15 will be favorably used, which ramps are laterally aligned to the position of a respective propulsion unit 4, preferably so that the center line of a ramp 15 is aligned with the vertical axis of a propulsion unit as seen along the ship's longitudinal direction. An alternative arrangement is also shown in Fig. 2, however, where the structural element providing space is a so called companionway structure 18 extending vertically in the ship through a multitude of deck structures 13, 14. In practice, such a companionway structure 18 contains an essential part of such technical and functional arrangements which extend vertically in the ship, like stairs, tubing etc. exemplified by showing an exhaust pipe 19. For safety reasons such a companionway structure 18 in practice is, indeed, divided by various horizontal bulkheads (not shown), but by having them appropriately positioned the space required for the top end of the propulsion unit 4 usually can be created.

By the arrangement according to the present invention standard arrangements for the propulsion unit 4 can be utilized, whereby significant improvements in servicing and ease of installation can be achieved as standard parts are used. The structure of the stern of the ship is more rigid, at least at the location of the propulsion unit 4, due to the stiffening effect provided by the ramp 15 or the like, whereby any bottom solutions at the stern of the ship, correspondingly, can be made lighter, which improves safety and facilitates the building of the ship.

Above some preferable embodiments of the present invention haven been presented, but it is obvious to a person skilled in the art that the present invention can be implemented in many other different manners within scope of the appended claims. Thus, for example, it is clear that an arrangement according to the present invention also can be implemented in the context of other than just azimuthing propulsion units.

Claims

1. An arrangement in a ship, said ship having a first cargo deck (13) extending essentially at the level of a lower edge of a loading gate (17) and further having at least one technical or functional structural part (15, 18) extending upwards from said deck, c h a r a c t e r i z e d in that said structural part (15, 18) of the ship, which part extends at least partially vertically, is positioned such, that at least a portion of a space defined by said structural part at the same time constitutes a space for such portions (8, 9, 11) of a propulsion unit (4) which portions are positioned within the ship's hull, when said propulsion unit is arranged rotatably around a vertical axis (A-A) in relation to said ship.

2. An arrangement according to claim 1, c h a r a c t e - r i z e d in that a loading ramp (15) constitutes said structural part providing said space for a top end portion of said propulsion unit (4), said loading ramp suitably being arranged longitudinally in said ship in such a manner that an entrance to said ramp, which entrance is arranged essentially at the level of said first deck (13), is located in the immediate vicinity of said gate (17), preferably so that said loading ramp (15) is located in the stern (1) of the ship, favorably so that said ramp structure (15), including wall structures (16) extending downwards from said ramp, constitutes a part of reinforcements of the structure of the ship's stern (1).

3. An arrangement according to claim 1, c h a r a c t e - r i z e d in that a companionway or the like structure (18) of the ship constitutes said structural part providing said space for propulsion unit's (4) top end portion, which companionway structure preferably is located in the stern of the ship and essentially above said propulsion unit (4).

4. An arrangement according to any one of claims 1 to 3, c h a r a c t e r i z e d in that said structural part (15,

18) providing said space is arranged, in the ship's lateral direction, so the structural part's (15, 18) center-line (B-B) extending in the ship's direction is essentially aligned with a vertical axis (A-A) of the propulsion device (4).

5. An arrangement according to any one of claims 1 to 4, c h a r a c t e r i z e d in that said structural part (15, 18) providing said space, including any wall structures (16) of said part, constitutes a separate standardized element, into which element a part of the propulsion device's (4) structure, devices and/or other arrangements are integrated.

6. An arrangement according to any one of claims 1 to 5, c h a r a c t e r i z e d in that multiple structural space providing parts, e.g., loading ramps (15) or companionways (18) and, correspondingly, propulsion devices (4, 4a) are arranged in the ship side by side.

7. A method for utilizing space in a ship having a gate (17) in at least one end, wherein a first cargo deck (13) extends at essentially the level of a lower edge of said gate (17), from which deck upwards extends a structural part (15, 18) serving technical and/or operational functions of the ship, said method being c h a r a c t e r i z e d in that such parts (8, 9, 10, 11) of a steering gear providing propulsive force (4) to the ship are positioned in a space defined by said structural part (15, 18), to which parts easy access is required for service or for some other reason.

8. A method according to claim 7, c h a r a c t e r i z e d in that a propulsion unit (4) is used as said steering gear providing propulsive force, said propulsion unit being rotatable in relation to the ship around a vertical axis (A-A), and space for said unit's turning elements (8, 9, 10) is arranged between said first deck (13) and an at least partially horizontal portion of said structural part (15, 18).

9. An installation arrangement for a propulsion unit (4) which is rotatable, in relation to a ship, around a vertical axis (A-A), wherein one portion (5, 6, 7) of said propulsion unit (4) is located outside the ship's hull ship and another portion (8, 9, 10, 11) is located within the ship's hull, respectively, c h a r a c t e r i z e d in that any parts (8, 9, 10, 11) to be installed within the ship's hull are positioned in a space which is formed upwards through a main deck (13), said space being defined in accordance with such an other structure (15, 18) pertaining to the ship, which structure extends above said main deck (13).

10. An installation arrangement according to claim 9, c h a r a c t e r i z e d in that said parts to be installed within the ship's hull include at least a turning machinery (8, 9, 10) for said propulsion unit (4).

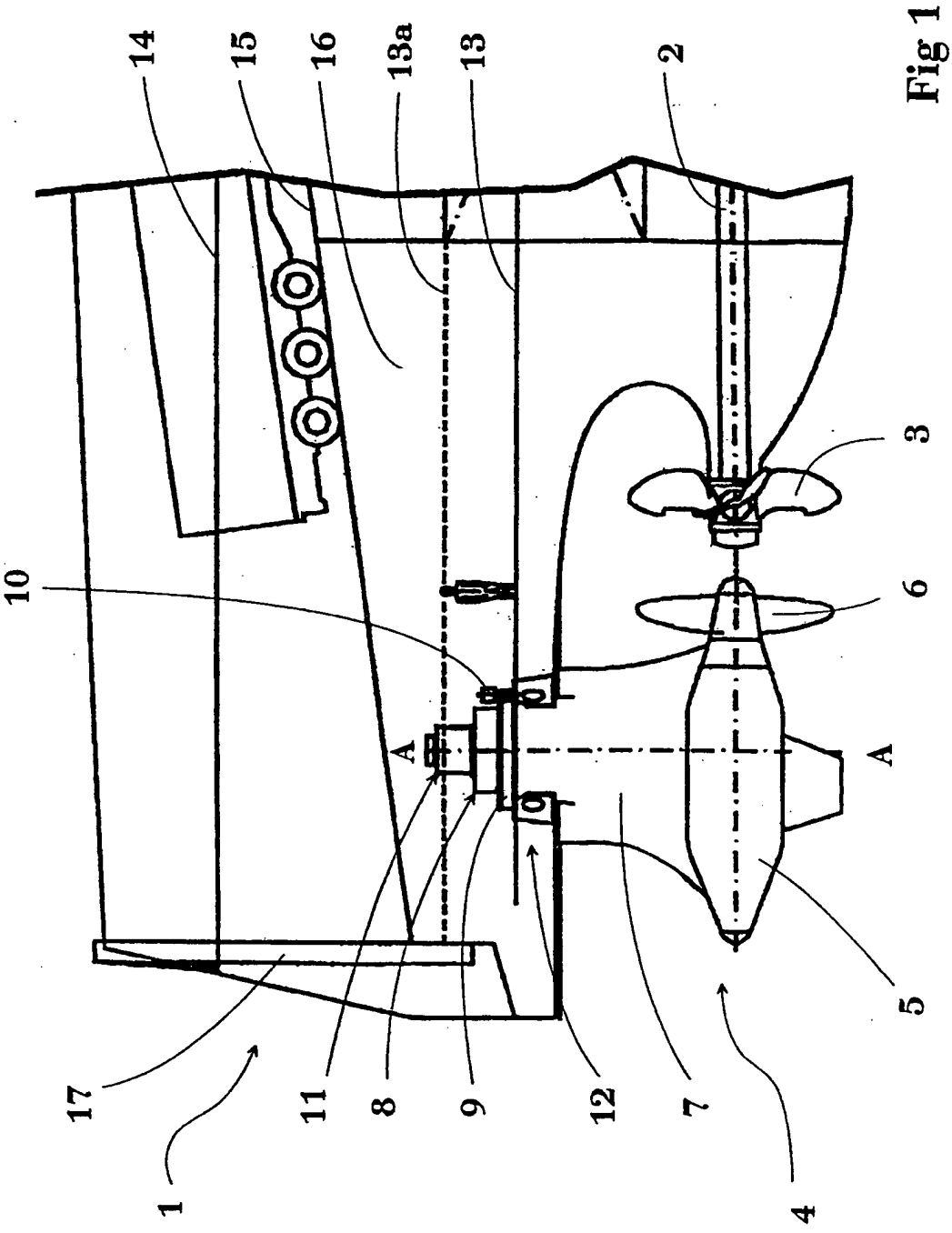

Fig 1

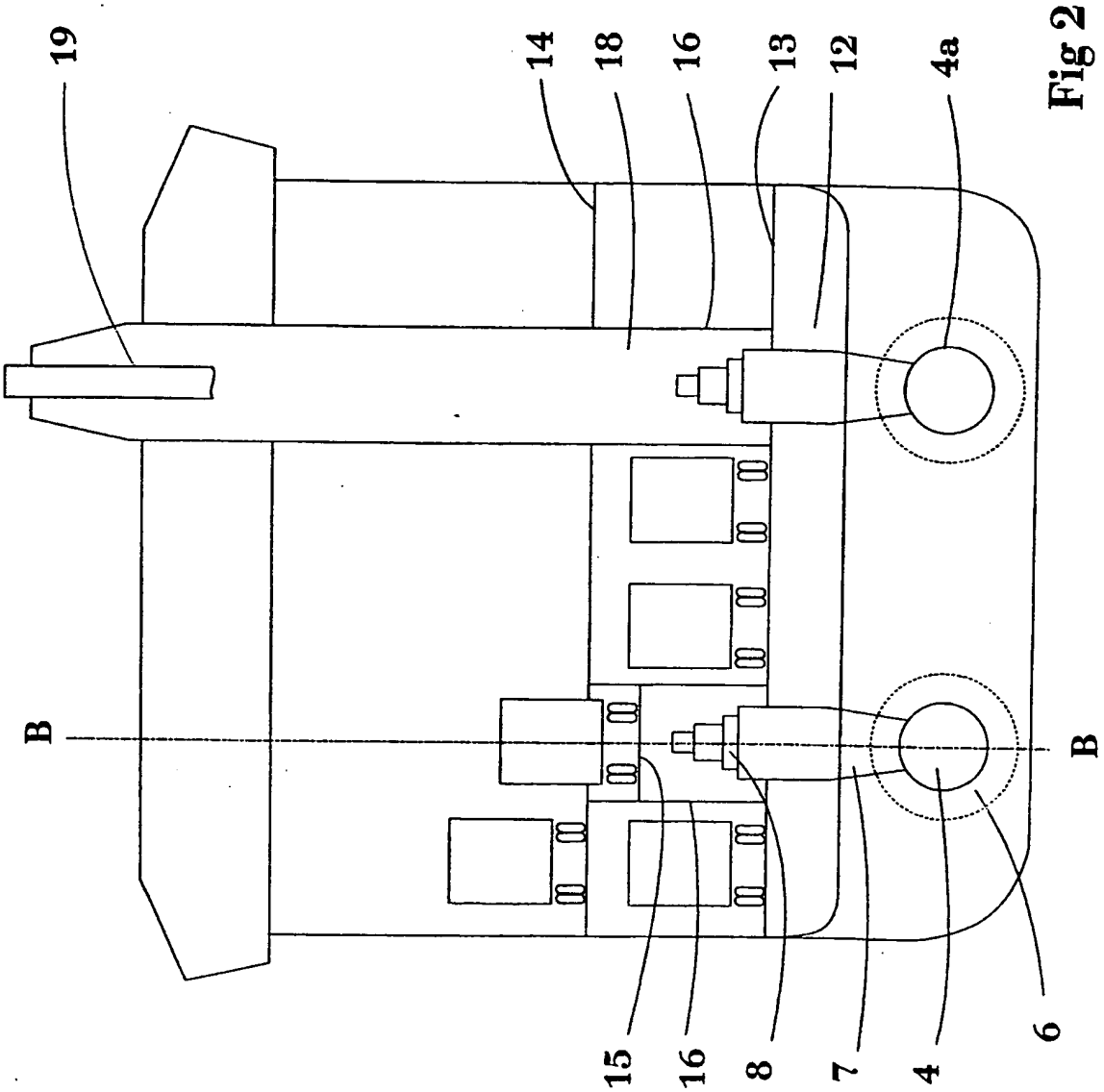

Fig 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 01/00075

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B63H 5/125, B63B 11/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B63B, B63H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1427080 B (TRANS-CONSULTANTS AB), 3 March 1976 (03.03.76), page 2, line 79 - line 81, figures 1,2, 4, claim 1	1,3,4,7-10
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A	US 4008675 A (JOHANSSON), 22 February 1977 (22.02.77), figures 1,2,5,7-10, abstract	1,2,4,7
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 June 2001	07 -06- 2001
Name and mailing address of the ISA: Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Björn Salén/LS Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/04/01

International application No.
PCT/FI 01/00075

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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